

What is claimed is:

1. A method of treating medical disorders comprising the step of modifying the ion concentration of brain fluid in the brain of a patient.
2. A method as in claim 1 of treating neurological disorders.
3. A method as in claim 2 further comprising the step of measuring the ion concentration of the brain fluid.
4. A method as in claim 2 further comprising modifying the ion concentration of brain fluid by delivering fluid to the brain, the ion concentration of the delivered fluid being such as to cause the ion concentration in the brain to be modified.
5. A method as in claim 4 further including replacing brain fluid.
6. A method as in claim 5 further including replacing brain fluid with brain fluid previously extracted from the brain.
7. A method as in claim 4 in which the step of delivering fluid to the brain includes delivering modulated ion-content fluid into the patient's brain into at least one localized region of the patient's brain.
8. A method as in claim 4 in which the step of delivering fluid to the brain includes pumping modulated ion-content fluid into the patient's brain according to a predetermined schedule of flow rate.
9. A method as in claim 4 in which the step of delivering fluid to the brain includes delivering modulated ion-content fluid into the patient's brain into a general region of the patient's brain.

10. A method as in claim 4 further comprising measuring ion concentration in said brain fluid after beginning said delivering of fluid to the brain, and adjusting the ion concentration of the delivered fluid based on the measured ion concentration.
11. The method of claim 4, further comprising the steps of calculating ion concentration in said brain fluid, using a membrane potential equation, and adjusting the delivery of modulated ion-content fluid, based on the calculated ion concentration.
12. The method of claim 11, wherein the membrane potential equation is the Goldman equation or a derivative or modification of the Goldman equation.
13. The method of claim 4, further comprising the steps of measuring the electrical conductivity of said brain fluid after delivering modulated ion-content fluid to the patient's brain, and adjusting the delivery of said modulated ion-content fluid, based on the measured electrical conductivity of said brain fluid.
14. The method of claim 4, wherein the delivery is of modulated ion-content fluid and said delivery is calculated using a membrane potential equation.
15. The method of claim 14, wherein the membrane potential equation is the Goldman equation or a derivative or modification of the Goldman equation.
16. The method of claim 4 wherein the delivery is of modulated ion-content fluid and the delivered fluid produces a voltage differential between intra-cellular fluid and extra-cellular fluid, which may be modified to such a level that epileptic seizures are controlled.

17. The method of claim 4 wherein the fluid is delivered to the patient's brain using closed-loop feedback.
18. The method of claim 4 further wherein the delivery is of modulated ion-content fluid and comprised of the step of adjusting the delivery of modulated ion-content fluid based upon the measured electrical activity of predetermined most likely epileptic brain cells.
19. The method of claim 4 wherein said delivery is of modulated ion-content fluid and said fluid is delivered to the brain using a dispersed delivery system.
20. The method of claim 4 wherein said delivery is of modulated ion-content fluid and said fluid is delivered to the brain ventricle.
21. The method of claim 4 wherein said delivery is of modulated ion-content fluid and said fluid is delivered to the brain using a computer-controlled pump.
22. The method of claim 4 wherein said delivery is of modulated ion-content fluid and said fluid is delivered to the brain at a predetermined location by direct injection into a localized region.
23. A system for controlling epileptic seizures comprising:
 - a) a brain fluid pumping mechanism, having an input, coupled to a patient's brain for extracting brain fluid, and having an output;
 - b) a fluid ion adjustment mechanism coupled to said output of said brain fluid pumping mechanism, said fluid ion adjustment mechanism having an output from which modulated ion-content fluid is produced; and

- c) a catheter, having an input coupled to the output of said ion adjustment mechanism and having an output inserted into a predetermined region of a patient's brain,
- whereby brain fluid is extracted from a patient's brain, ion-concentration of said fluid is adjusted and said brain fluid is re-injected into said brain.
24. A system as in claim 23 in which the system includes computer control that reads and executes stored program instructions that cause the pumping mechanism to pump the extracted fluid according to the program and its parameters.
25. A system as in claim 23 further comprising a probe in the brain providing an output related to measurement of an ion-concentration related brain parameter, the system including computer control which reads the output of the probe to responsively control at least one of fluid extraction, fluid delivery, and ion concentration.
26. A system as in claim 25 in which the computer control calculates ion concentration in brain fluid using the Goldman equation, and adjusts the delivery of modulated ion-content fluid based on the calculated ion concentration.
27. A system as in claim 25 in which the computer control calculates ion concentration in brain fluid using a membrane potential equation.
28. A system as in claim 27 in which the membrane potential equation is the Goldman equation or a derivative or a modification of the Goldman equation.
29. A system for controlling epileptic seizures comprising:

- a) a fluid pumping mechanism, having an input, coupled to a fluid source selected from the group consisting of a patient's brain and a source other a patient's brain, and having an output;
 - b) a fluid ion adjustment mechanism coupled to said output of said brain fluid pumping mechanism, said fluid ion adjustment mechanism having an output from which modulated ion-content fluid is produced; and
 - c) a catheter, having an input coupled to the output of said ion adjustment mechanism and having an output inserted into a predetermined region of a patient's brain, whereby modulated ion-content fluid can be injected into the brain.
30. The apparatus of claim 29 wherein output of the catheter includes a fluid passageway to provide modulated ion-content fluid into the patient's brain into at least one localized region of the patient's brain.
31. The apparatus of claim 29 wherein the fluid pumping mechanism includes means for pumping the modulated ion-content fluid into the patient's brain according to a predetermined flow rate.
32. The apparatus of claim 29 wherein output of the catheter includes a fluid passageway to provide modulated ion-content fluid into the patient's brain into a general region of the patient's brain.

33. The apparatus of claim 29 further comprising means for measuring ion concentration in the brain fluid after the modulated ion-content fluid is injected into the patient's brain.
34. The apparatus of claim 33 wherein the fluid pumping mechanism or fluid adjustment mechanism includes means for adjusting the delivery of the modulated ion-content fluid based on the measured ion concentration.
35. The apparatus of claim 29 further comprising:
means for calculating ion concentration in the brain fluid using a membrane potential equation;
the fluid pumping mechanism or fluid ion adjustment mechanism including means for adjusting the delivery of the modulated ion-content fluid based upon the calculated ion concentration.
36. The apparatus of claim 29 further comprising means for measuring the electrical conductivity of the brain fluid after the modulated ion-content fluid is injected into the patient's brain; the fluid pumping mechanism or fluid ion adjustment mechanism including means for adjusting the delivery of the modulated ion-content fluid, based upon the measured electrical conductivity of the brain fluid.
37. The apparatus of claim 36 wherein the means for measuring the electrical conductivity of the brain fluid after the modulated ion-content fluid is injected into the patient's brain comprises an electrical probe configured and adapted for insertion into brain fluid to measure conductivity or resistance of brain fluid.

38. The apparatus of claim 35 wherein the membrane potential equation is the Goldman equation or a derivative or modification of the Goldman equation. calculating the ion concentration of the brain fluid using the Goldman equation.
39. The apparatus of claim 36 wherein the ion fluid adjustment mechanism is adapted such that the modulated ion-content fluid injected into the brain produces a voltage differential between intra-cellular fluid and extra-cellular fluid that is modified to such a level that epileptic seizures are controlled.
40. The apparatus of claim 39 further comprising closed-loop feedback means for delivery of the modulated ion-content fluid to the patient's brain.
41. The apparatus of claim 29 further comprising means for measuring electrical activity of predetermined most likely epileptic brain cells, the fluid pumping mechanism or fluid ion adjustment mechanism including means for adjusting the delivery of the modulated ion-content fluid based upon measured electrical activity of predetermined most likely epileptic brain cells.
42. The apparatus of claim 29 wherein the catheter comprises a dispersed delivery system for injecting modulated ion-content fluid to the patient's brain.
43. The apparatus of claim 29 wherein the catheter is configured and adapted to provide the modulated ion-content fluid to a brain ventricle.
44. The apparatus of claim 29 wherein the fluid pumping mechanism comprises computer-controlled pump.

45. The apparatus of claim 29 wherein the catheter is configured and adapted to provide the modulated ion-content fluid to the brain at a predetermined location by direct injection into a localized region.
46. The apparatus of claim 29 which the fluid ion adjustment mechanism includes an ion exchange mechanism to adjust fluid ion concentration.
47. The apparatus of claim 46 in which the ion exchange mechanism comprises means for filtering fluid to adjust fluid ion concentration.
48. The apparatus of claim 46 in which the ion exchange mechanism comprises chemical means for treating fluid to adjust ion concentration.
49. Apparatus for treating epilepsy and other neurological disorders of the brain comprising:
 - means for modifying ion concentrations of a fluid to render modulated ion-content fluid using a predetermined process;
 - means for substantially continuously pumping the modulated ion-content fluid into a localized region of the patient's brain;
 - means for monitoring the ion concentration of brain fluid proximate to the region where the ion-content fluid is pumped to the patient's brain.
50. The apparatus of claim 49 further comprising means for diagnosing an epileptic condition in a patient.